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Supplement I:
Annotated Bibliography of the Horn Fly,
***Haematobia irritans irritans* (L.)**
Including References on the Buffalo Fly,
***H. irritans exigua* (de Meijere), and Other**
Species Belonging to the Genus *Haematobia*

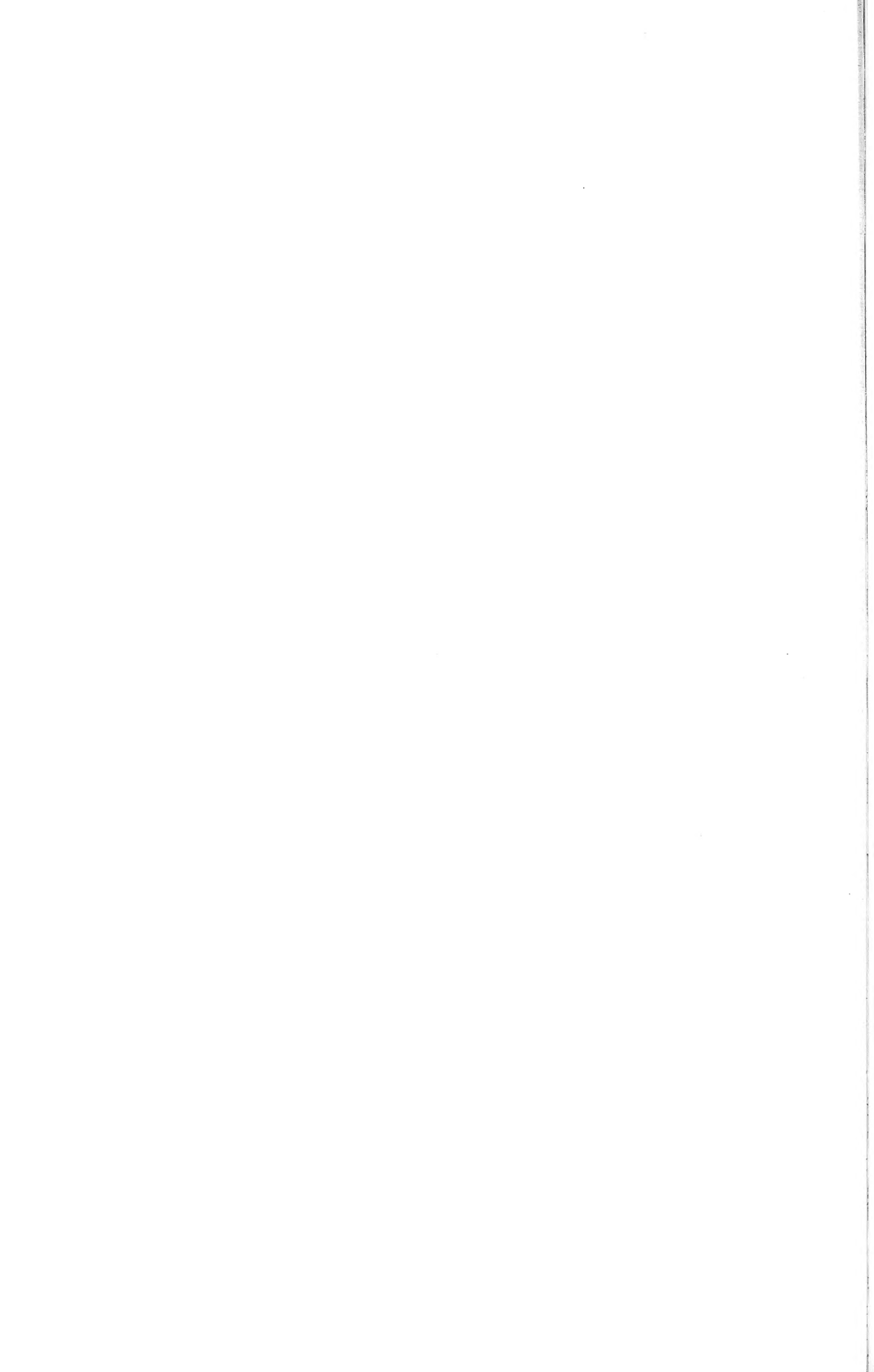
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SPECIES CITED IN REFERENCES

- Haematobia* Lepeletier & Serville (1828)
Lyperosia Rondani (1856)
Priophora Robineau-Desvoidy (1863)
Glossinella Grunberg (1906)
Haphospatha Enderlein (1924)
Siphona auct. (nec Meigen)
 irritans irritans (Linnaeus, 1758)
 pungens (Fabricius, 1794)
 serrata Robineau-Desvoidy (1830)
 tibialis Robineau-Desvoidy (1830)
 cornicola Williston (1889)
 meridionalis (Bezzi, 1911)
 rufifrons (Bezzi, 1911)
 weissi (Bezzi, 1911)
 irritans exigua de Meijere (1903)
 flavohirta (Brunetti, 1910)
 australis Malloch (1932)
 spinigera Malloch (1932)
 schillingsi (Grunberg, 1906)
 minuta (Bezzi, 1892)
 longipalpis (Roubaud, 1906)
 potrix (Enderlein, 1928)
 meridiana Zumpt (1973)
 thirouxi thirouxi (Roubaud, 1906)
 hirudo (Enderlein, 1924)
 minuta (Enderlein, 1928, nec Bezzi)
 thirouxi potans (Bezzi, 1907)
 pallidipes (Roubaud, 1907)
 thirouxi titillans (Bezzi, 1907)
 irritans (Rondani, 1862, nec Linnaeus)
 tibialis (Hough, 1900, nec Robineau-Desvoidy)
 equina (Enderlein, 1928)
 latirostris (Enderlein, 1928)
 bovina (Peus, 1937)
 scolopax (Peus, 1937)

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***H. irritans exigua* (de Meijere), and**
Other Species Belonging to the Genus *Haematobia*

Clyde E. Morgan and Gustave D. Thomas¹

This supplement is the first to "Annotated Bibliography of the Horn Fly, *Haematobia irritans* (L.), Including References on the Buffalo Fly, *H. exigua* (de Meijere), and Other Species Belonging to the Genus *Haematobia*," published in 1974 (U.S. Dep. Agric., Misc. Publ. No. 1278).

Included in this supplement are literature citations on *Haematobia* published from 1971 through 1975 and publications prior to 1971 omitted in the previous bibliography. Literature containing original information relating to biology, systematics, distribution, and control of *Haematobia* is annotated. Literature summarizing known information of minor importance is listed.

Abbreviations used in the citations are constructed according to the rules of the "American National Standard for Abbreviation of Titles of Periodicals" and can be found in "BIOSIS 1974 List of Serials with Coden, Title Abbreviations, New, Changed, and Ceased Titles," published by Bio-Science Information Service of Biological Abstracts.

In 1973, F. Zumpt, South Africa, presented a treatise revising the Stomoxyinae of the world. We list his classification of *Haematobia* to assemble the many synonymous species in this and the previous bibliography, and to bring information on the genus up to date. Currently *Haematobia* is comprised of six species including five subspecies.

¹Biological Control of Insects Research, Agricultural Research Service, Columbia, Mo.

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Lyperosia (= *Haematobia*) *minuta* showed preference for windy steppes.
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Irradiation of colony-reared 30-hr-old pupae with 2,500 rad completely inhibited fly emergence; with irradiation of 54-hr-old pupae, some flies emerged, but all died within 3 days. Adults from irradiated 78-hr-old pupae emerged, but unusual numbers died within 3 days. Neither emergence nor survival was affected adversely when 102 or 126-hr-pupae were irradiated. Pupal irradiation with 2,000 and 2,500 rad induced sterility in the adult flies.

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Testosterone propionate treated steers and bulls had larger sebaceous gland cells than the control steers. *Inspection of 1973*

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Lyperosia (= *Haematobia*) *minuta* was recovered from camels in Western Aden Protectorate.
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Described *Haphospatha hirudo* (= *H. t. thirouxii*).
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- A sprayer was developed to provide animal-activated ULV application of insecticides to cattle. Fly control was obtained with all of the insecticides tested.
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H. i. irritans were reared on bovine feces and artificial media containing various proportions of sugar cane bagasse, whole wheat flour, fishmeal, baking soda, and water. Bovine feces appeared essential for maximum fly production, but an artificial medium could be substituted for some of the feces.
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 109. ESSIG, H. W., W. A. PUND, and C. F. BAILEY. 1964. A study of horn fly control in beef cattle. *Miss. State Univ. Agric. Exp. Stn. Inform. Sheet* 859, 2 pp.
Mineral blocks containing ronnel were used for horn fly control.
 110. FABRICIUS, J. C. 1805. *Systema Antliatorum secundum ordines, genera, species*. *Brunsvigae* (=Brunswick), p. 281.
 111. FAN, C. T. 1965. Key to the common synanthropic flies in China. (In Chinese.) *Academy of Sciences, China*, 330 pp.
We have not seen this reference, but it is listed in Shinonaga and Kano, 1971, and Zumpt, 1973.
 112. FAY, R. W., and J. W. KILPATRICK. 1958. Insecticides for control of adult Diptera. *Annu. Rev. Entomol.* 3: 401-420.
 113. FERNANDEZ-SOUSA, J. M., J. G. GAVILANES, A. M. MUNICO, and others. 1975. Primary structure of cytochrome c from the insect *Ceratitis capitata*. *Biochem. Biophys. Acta* 393(2): 358-367.
Amino acid sequence of cytochrome c from *C. capitata* was compared with that of *H. i. irritans*.
 114. FERRAR, P. 1973. The CSIRO dung beetle project. *Wool Technol. Sheep Breed.* 20(1): 73-75.
 115. ——— 1975. Disintegration of dung pads in north Queensland before the introduction of exotic dung beetles. *Aust. J. Exp. Agric. Anim. Husb.* 15(74): 325-329.

116. FINCHER, G. T., R. DAVIS, and T. B. STEWART. 1971. Flight activity of coprophagous beetles on a swine pasture. *Ann. Entomol. Soc. Am.* 64(4): 855-860.
117. FORDHAM, W. J. 1945. A preliminary list of the Diptera of Northumberland and Durham (excluding the Cecidomyiidae). *Trans. Nat. Hist. Soc. Northumberl. Durham Newcastle-Upon-Tyne (New Ser.)* 7: 197-265.

Haematobia (= *Haematobosca*) *stimulans* was included in the Diptera list.
118. FREY, R. 1924. Diptera Brachycera. In Dampf, A. *Zur Kenntnis der estlandischen Hochmoorfauna. Sitzungsberichte Naturforscher-Gesellschaft Universitat Dorpat* 31: 55.

Haematobia (= *Haematobosca*) *stimulans* was listed.
119. GAMAL-EDDIN, F. M. 1968. Field studies on the biting cycle of two bloodsucking flies (*Siphona irritans* and *Musca crassirostris*) in Egypt. *J. Egypt Vet. Med. Assoc.* 28(1/2): 83-91.

On cattle, *H. i. irritans* has two peaks of biting activity during the different seasons—during spring and summer the afternoon peaks were slightly higher than the morning peaks; the reverse was true during late autumn and winter. On donkeys, only one peak of biting activity was noted (in the morning).
120. ——— 1971a. Field and laboratory studies on the life cycle of the blood-sucking, ectoparasitic fly *Siphona irritans*, Lin. in Egypt (Diptera: Muscidae). *J. Egypt. Vet. Med. Assoc.* 31(3/4): 243-250.

Oviposition lasted an average of 9.5 days at 30° C and 13 days at 25° C. At natural temperatures, the average number of eggs deposited was at its lowest (20) for the year in October and rose gradually to a maximum of 125 in May, after which it again declined. At constant temperatures of 20° and 30° C, an average of 74.3 and 142.5 eggs were deposited respectively.
121. ——— 1971b. Studies on the behavior of the blood-sucking fly *Siphona irritans* Lin. towards some environmental factors, to pave the way for proper control. A. The adult stage. (2). Reactions to temperature. *J. Egypt. Vet. Med. Assoc.* 31(3/4): 251-262.

Lab studies showed that in choice-chamber experiments, *H. i. irritans* exhibited a preference for temperatures between 20° and 35° C. Preconditioning had no effect on the subsequent behavior of the flies.
122. ——— 1972a. Field and laboratory studies on the life cycle of the blood-sucking ectoparasitic fly *Siphona irritans*, Lin. in Egypt. (2) The egg stage. *J. Egypt. Vet. Med. Assoc.* 32 (1/2): 45-53.

Duration of the egg stage varied from an average of 30 hr at 20° C to 11.2 days at 33.5° C. Eggs held below 90 percent RH did not hatch. As the temperature increased, the lower limit of humidity at which hatching occurred was reduced.

123. ——— 1972b. Field and laboratory studies on the life cycle of the blood-sucking ectoparasitic fly *Siphona irritans*, Lin. in Egypt. 3. The larval and pupal stages and their micro habitats in nature. J. Egypt. Vet. Med. Assoc. 32(1/2): 55-74.
Duration of the three larval instars varied from 13 days at 18° C to 3.8 days at 32° C; duration of the pupal stage varied from 13.5 days at 18° C to 3.9 days at 31° C. Pupal period was shorter at 98 percent RH than at 90, 95, or 100 percent RH at 25° C. Field studies included observations on temperature, RH, and pH of cow pats. In Egypt optimum developmental temperatures occurred in the spring.
124. ——— 1972c. Studies on the behavior of the blood-sucking fly *Siphona irritans*, Lin. toward some environmental factors, to pave the way for proper control. (Diptera: Muscidae) A. The adult stage. (3) Smell reaction and olfactory receptors. J. Egypt. Vet. Med. Assoc. 32 (3/4): 229-246.
Reactions of *H. i. irritans* to the smell of animals and dung were studied. Various combinations of smell, temperature, and humidity were tested. The degree of moistening of the host's body was found to determine the degree of abundance of flies on the host.
125. GJULLIN, C. M., and V. D. BEVILL. 1972. Insect chilling table. J. Med. Entomol. 9(3): 266.
126. GLASER, R. W. 1923. The effect of food on longevity and reproduction in flies. J. Exp. Zool. 38(3): 383-412.
H. i. irritans could be kept in captivity for 2 to 25 days but ceased egg laying 2 to 5 days after capture.
127. GMELIN, J. F. 1790. Caroli a Linne', systema naturae per Regna Tria Naturae. (ed. 13). vol. 1: Regnum Animale, pt. 5. Lipsiae (=Leipzig). p. 2892.
128. GOBLE, H. W. 1948. Insects attacking man and domestic animals. Can. Insect Pest Rev. 26: 56, 80, 85.
129. ——— 1950. Insects affecting man and domestic animals. Can. Insect Pest Rev. 28: 56, 92.
130. GONZALEZ, R. H. 1968. *Haematobia irritans* (L.) en Chile. Rev. Chil. Entomol. 6: 142.
Collected *H. i. irritans*, not previously known in Chile.
131. GONZALEZ-RINCONES, R., and L. GUYON. 1953. Classificacion general de los Dipteros. Caracas, pp. 118-125.

132. GOTWALD, W. H. 1965. A checklist and keys to the Muscinae and Stomoxydinae (Diptera: Muscidae) of Pennsylvania. *Entomol. News* 76: 199-210.
133. GRAHAM, O. H., R. O. DRUMMOND, and R. A. HOFFMAN. 1968. Possibilities of the sterile-male technique for the control of livestock insects in the United States of America. *In* Control of Livestock Insect Pests by the Sterile-Male Technique. (Panel Proc. Ser.) Int. At. Energy Agency. pp. 41-44.
134. GREENBURG, B., and D. POVOLNY'. 1971. Bionomics of flies. *In* Greenburg, B. Flies and Disease. vol. 1. Princeton p. 65.
135. GREGOR, F., and D. POVOLNY'. 1958. Versuch einer klassifikation der synanthropen fliegen. *J. Hyg. Epidemiol. Microbiol. Immunol.* (Prague) 2: 205-216.
136. ——— and D. POVOLNY'. 1960. Beitrag zur kenntis der synanthropen fliegen ungarns. *Cas. Cesk. Spolecnosti Entomol.* 57(2): 158-177.
137. GRIFFITHS, G. C. D. 1972. The Phylogenetic classification of Diptera Cyclorrhapha. The Hague, pp. 146-147.
Abdominal structures were used in the classification of *H. i. irritans*.
138. GRIFFITHS, R. B. 1974. Parasites and parasitic diseases. pp. 236-275. *In* Cockrill, W. R. (ed.) The Husbandry and Health of the Domestic Buffalo. FAO, Rome, 993 pp.
H. i. exigua populations on buffalo were larger than those on cattle; buffalo appeared not to suffer from feeding activity of the flies.
139. GRUNBERG, K. 1907. Die Blutsaugenden Dipteren. Jena, pp. 160-161.
140. HAESELBARTH, E., J. SEGERMAN, and F. ZUMPT (ed.). 1966. The arthropod parasites of vertebrates in Africa south of the Sahara (Ethiopian region). Vol. III, Publ. S. Afr. Inst. Med. Res. 13(52): 35-37.
141. HAEUSSLER, G. J. 1952. Losses caused by insects. U.S. Dep. Agric., Yearb. 1952: 144.
142. HAFEZ, M., and F. M. GAMAL-EDDIN. 1968. The feeding habits of the horn fly (*Siphona irritans*) with special reference to its biting cycle in nature in Egypt (Diptera: Muscidae). *Bull. Soc. Entomol. Egypte* 50(59): 41-52.
143. HARDY, D. E. 1952. Additions and corrections to Bryan's check list of the Hawaiian Diptera. *Hawaii. Entomol. Soc. Proc.* 14: 480-481.

144. HARLEY, J. M. B. 1965. Seasonal abundance and diurnal variations in activity of some *Stomoxys* and Tabanidae in Uganda. Bull. Entomol. Res. 56(2): 319-332.
145. HARRIS, R. L., W. F. CHAMBERLAIN, and E. D. FRAZAR. 1974. Horn flies and stable flies: free choice feeding of methoprene mineral blocks to cattle for control. J. Econ. Entomol. 67(3): 384-386.
- With 0.94, 0.12, and 0.01 percent methoprene in mineral blocks, development of *H. i. irritans* in the field was inhibited 87 percent. Bioassay data in the laboratory indicated better than 97 percent inhibition.
146. ——— E. D. FRAZAR, and R. L. YOUNGER. 1973. Horn flies, stable flies, and house flies: development in feces of bovines treated orally with juvenile hormone analogues. J. Econ. Entomol. 66(5): 1099-1102.
- H. i. irritans* development was inhibited in feces of cattle treated orally with 1 g/day of Hoffman-La Roche Ro7-9767 and 0.7 mg/day of Zoecon ZR-515.
147. ——— J. A. MILLER, and E. D. FRAZAR. 1974. Horn flies and stable flies: feeding activity. Ann. Entomol. Soc. Am. 67(6): 891-894.
- An electronic bitometer was used to determine the feeding activity of *H. i. irritans* feeding on a cow. Females spent an average of 163 min/day in feeding and averaged 38.4 feedings/day. Males averaged 24 feedings/day and spent an average of 96 min/day in feeding. In the laboratory female horn flies averaged 10 feedings/day and spent an average of 15.3 min/day in feeding.
148. HASEGAWA, T., H. HAYAKAWA, and T. CHIBA. 1973. Sand flies in Tohoku area, Japan. (In Japanese.) Jpn. J. Sanit. Zool. 23(4): 271.
149. HAUFÉ, W. O. 1970. An economic evaluation of horn fly control on yearling cattle treated with DDT and coumaphos. Annu. Meeting Can. Soc. Anim. Production Proc., July 5-9, Ottawa. pp. 48-49.
150. ——— 1973a. Horn fly. Can. Agric. Insect Pest Rev. 51: 48.
151. ——— 1973b. Interaction of pesticidal toxicity, parasites, and reversible anticholinesterase activity as stresses on growth rate in cattle infested with horn flies (*Haematobia irritans*). Toxicol. Appl. Pharmacol. 25(1): 130-144.
- Differential rates of gain in groups of immature cattle exposed to *H. i. irritans* attack were used to distinguish the interaction of pesticidal activity and nonpesticidal pharmacologically induced stress with host-parasite reaction.

152. ——— 1974. Haematophagus flies—a component in the impact of environment on the health and productivity of cattle. Int. Livestock Symp. Proc., Am. Soc. Agric. Engin., Ser. Publ. SP-0174. pp. 203-208.
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154. HAYES, B. W., M. J. JANES, and D. W. BEARDSLEY. 1972. Dust bag treatments in improved pastures to control horn flies and cattle grubs. J. Econ. Entomol. 65(5): 1368-1371.
The 3-year study included various combinations of treatments of 1 and 5 percent coumaphos, 5 and 10 percent prolate, and 10 percent methoxychlor. All were effective in controlling *H. i. irritans* on Brahman-Angus or Brahman-Hereford cross-bred steers.
155. HEDLUND, L., L. HAHN, G. THOMAS, and H. D. JOHNSON. 1972. Effect of flies on body movement of dairy cows. (Abstract) J. Anim. Sci. 35: 166.
156. HEIMPEL, A. M. 1967. A critical review of *Bacillus thuringiensis* var. *thuringiensis* Berliner and other crystalliferous bacteria. Annu. Rev. Entomol. 12: 296.
157. HENNEGUY, L. F. 1904. Les insectes. Paris, p. 200.
158. HENNIG, W. 1952. Dipteren von den Suda-Inseln. IV. Fam. Muscidae. Beitr. Entomol. 2:93.
159. ——— 1964. Fam. 63b. Muscidae lfg. 249: 1009-1056. In Lindner, E. (ed.), Die Fliegen der Palaearktischen Region. Stuttgart.
160. ——— 1965. Vorarbeiten zu einem phylogenetischen system der Muscidae (Diptera: Cyclorrhapha). Stuttg. Beitr. Naturkd. 141: 76-79.
161. ——— 1968. Die Larvenformen der Dipteren. 3. Teil. Berlin pp. 365-366, 372-373.
162. HERTING, B. 1957. Das weibliche postabdomen der calyptraten fliegen (Diptera) und sein merkmalswert fur die systematik der gruppe. Z. Morph. Okol. Tiere 45: 436.
163. HINTON, H. E. 1960. The chorionic plastron and its role in the eggs of the Muscinae (Diptera). Q. J. Microsc. Sci 101: 313-332.
164. HOELSCHER, C. E., and R. L. COMBS. 1970. The horn fly. II. Comparative physiological studies of reproductive and diapaused pupae. Physiol. Zool. 43(4): 241-248.

Respiration rate decreased threefold to fivefold when diapaused pupae were compared with reproductive specimens. Moisture content was 63.7 percent for reproductive pupae and 44.7 percent for diapaused pupae. No differences observed in lipid content in pupal samples. Glycerol was not found in reproductive pupae, but was present in diapausing pupae.

165. ——— and R. L. COMBS. 1971. The horn fly. III. Sex ratio and factors affecting adult emergence. *Ann. Entomol. Soc. Am.* 64(4): 912-919.

A 1:1.35 male to female ratio was found from the total of 65,702 flies collected from pastured cattle during 2 years. A higher proportion of male horn flies was found in collections from the legs of calves. Temperature controlled emergence completely, but the effects of temperature were altered by photoperiod. Female flies emerged earlier than male flies in various tests. Photoperiod had the most pronounced effect on emergence when the larval and pupal stages were reared at a 12-hour reciprocal photophase of field conditions.

166. HOMAN, H. W., and E. P. DUREN. 1975. Horn fly control on range and pastures. Idaho Univ. Coop. Ext. Serv., Current Inform. Ser. No. 282, 2 pp.

167. HORI, K. 1960. Comparative anatomy of the internal organs of the calyptrate muscoid flies. I. Male internal sexual organs of the adult flies. *Sci. Rep. Kanazawa Univ.* 7(1): 34.

H. i. exigua was used in the study.

168. HORNE, W. T., E. O. ESSIG, and W. B. HERMS. 1923. Plant disease and pest control. Univ. Calif. Agric. Exp. Stn. Circ. 265, p. 63.

169. HORNING, B. 1959. Fliegen als ubertrager parasitarer wurmer. *Z. Angew. Zool.* 46: 338-342.

H. i. exigua was thought to be a vector of habronemiasis.

170. HOUGH, G. N. 1899. Some Muscinae of North America. *Biol. Bull. (Lancaster)* 1(1): 19-33.

Described differences between *H. serrata* (= *H. i. irritans*) and *H. alcis* (= *Haematobosca stimulans*).

171. ——— 1900. Notes on some European species of Calliphorinae, Muscinae Muscaeformes and Muscinae Ariciaeformes in the collection of the Hungarian National Museum. *Termesztud. Fuzetek.* 23: 249-250.

Discussed synonymy of *H. i. irritans*.

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173. HUKUSIMA, S., and S. TAKEDA. 1973. Biological studies of horse fly and horn fly in the Iwai pasture, Gifu prefecture located at upland region and repellent tests against them. (In Japanese.) Res. Bull. Fac. Agric. Gifu Univ. 34: 71-88.
174. HUCKETT, H. C. 1965. Family Muscidae. pp. 869-915. In Stone, A., C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Coulson. (ed.) A Catalog of the Diptera of America North of Mexico. U.S. Dep. Agric., Agric. Res. Serv., Agric. Handb. No. 276, 1,696 pp.
175. ISHIJIMA, H. 1967. Revision of the third stage larvae of synanthropic flies of Japan (Diptera: Anthomyiidae, Muscidae, Calliphoridae, and Sarcophagidae). Jpn. J. Sanit. Zool. 18: 47-100.
Included descriptions of *Lyperosia exigua* (= *H. i. exigua*) and *H. sanguinolenta* (= *Haematobosca sanguinolenta*).
176. JACOBS, S. N. A. 1971. Applied ecology used against a fly pest problem in Australia. Entomol. Rec. J. Var. 83(11): 353-355.
General review of dung beetle program.
177. JANES, M. J., B. W. HAYES, and D. W. BEARDSLEY. 1970. Dust bags control horn flies in improved pastures. Sunshine State Agric. Res. Rep. 15(2/3): 15-16.
178. JONES, B. F. 1973. Control profit-stealing horn flies. Arkansas Cattle. Bus. 9(6): 7-9.
179. ——— and G. BARNES. 1974. Protect beef cattle from external parasites. Univ. Arkansas Coop. Ext. Serv. Leaflet 285 (Rev. Annu.) 6 pp.
180. KABOS, W. J. 1951. De Diptera Brachycera van het eiland Texel, oecologisch beschouwd. Tijdschr. Entomol. 93: 127.
181. ——— 1964. Tweevleugelige insekten—Diptera. VIII. De Nederlandse vliegen (Muscidae). Wet. Meded. K.N.N.V. (K. Ned. Natuurhist. Ver.) 53: 1-32.
H. (= *Haematobosca*) *stimulans* and *Lyperosia irritans* (= *H. i. irritans*) were among species discussed.
182. ——— 1975. Two-winged insects—Diptera. Flies of the Netherlands (Muscidae). 2d amplified edition. (In Dutch.) Wet. Meded. K.N.N.V. (K. Ned. Natuurhist. Ver.) No. 110, 64 pp.
183. KANGWAGYE, T. N. 1973. Diurnal and nocturnal biting activity of flies: Diptera in Western Uganda. Bull. Entomol. Res. 63(1): 17-29.
Day and night catches of biting flies were made from bullock, buffalo, and at a light. Species collected were classified according to the time of day at which they bit. Flies caught in early morning included *H. minuta*, *H. spinigera* and *H. t. thirouxi*.

184. ——— 1974. The seasonal incidence of biting flies in Rwenzori National Park and Kigezi Game Reserve, Uganda. *Bull. Entomol. Res.* 63(4): 535-549.

Biting flies were collected from traps and bait animals. *H. minuta* was the only species to show a unimodal peak. This was attributed to maintenance of soil conditions suitable for the larvae during short rains (September through November). A bimodal peak was shown by *H. spinigera* (minimum numbers in the wet months—September and October).
185. KANO, R. 1954. Nippon no hae. (In Japanese.) DDT Kyokai. pp. 16, 55.
186. ——— 1959. Illustrated insect larvae of Japan. (In Japanese.) Tokyo. p. 692.

Characteristics given for identification of *H. i. exigua*.
187. ——— 1965. Iconographia insectorum Japonicorum colore naturali edita. vol. 3. (In Japanese.) Tokyo, p. 231.
188. ——— S. SHINONAGA, and T. HASEGAWA. 1972. On the specific name of *Haematobia* (Diptera, Muscidae) from Japan. (In Japanese.) *Jpn. J. Sanit. Zool.* 23(1): 49-56.

H. i. irritans and *H. i. exigua* were distinguishable; the *Haematobia* of Japan believed to be *H. i. irritans*. Characters given to separate *H. i. irritans* from *H. i. exigua*.
189. KARL, O. 1928. 13 Teil. Zweiflugler oder Diptera. III: Muscidae. In Dahl, F. Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise. Jena, pp. 14-15.
190. KELLOGG, V. L. 1905. American insects. New York, pp. 342-343.
191. KING, H. H. 1911. Report of the entomological section of the Wellcome Tropical Research Laboratories. In Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum. Vol. B, General Science (A. Balfour, Ed.) p. 126, plate VI.

Lyperosia (= *Haematobia*) *minuta*, *L. thirourxi* (= *H. t. thirourxi*), and *L. exigua* (= *H. i. exigua*) were collected in Sudan.
192. KINZER, H. G. 1971. Dust-bag and backrubber application of insecticides for control of the horn fly. *Vet. Med. Rev.* pp. 83-97.
193. ——— and J. M. REEVES. 1974. Dispersal and host location of the horn fly. *Environ. Entomol.* 3(1): 107-111.

H. i. irritans host location in relation to various environmental factors was investigated. No significant differences were shown between the success of newly emerged and day-old flies in locating hosts or between males and females of either age. In weather conditions, horn fly dispersal and subsequent host location appeared to be random with respect to predominant wind direction. Directional movements, however, were influenced by temperature, wind velocity, and humidity. There was a strong tendency for both parous and nulliparous flies to transfer from one host to another.

194. KIRKWOOD, A. C., and D. W. TARRY. 1973. A survey of some species of flies associated with cattle. *Int. Pest Control* 15(5): 6-10.

H. i. irritans was among various species of flies caught on and near a tethered calf in Surrey, England.

195. KNAPP, F. W. 1972. Prevention of cattle grub infestation in lactating dairy cows by use of daily applications of crotoxyphos. *J. Econ. Entomol.* 65(2): 466-467.

196. ——— 1972. Evaluation of dust bags for horn fly control on cattle. *J. Econ. Entomol.* 65(2): 470-472.

Information on self-dusting stations and the efficacy of several different insecticides was presented. Dusts tested included 3 percent and 5 percent stirofos, 5 percent coumaphos, 3 percent malathion, 5 percent ronnel, 5 percent fenthion, and 3 percent crotoxyphos.

197. KNIPLING, E. F. 1959. The use of DDT in veterinary medicine. *In* S.W. Simmons (ed.). *DDT, the Insecticide Dichlorodiphenyl-trichloroethane and Its Significance*, vol. 2, Basel, pp. 522-528.

198. ——— 1972. Integrated control of livestock insect pests. pp. 379-397. *In* Khan, M. A., and W. O. Haufe. (ed.) *Toxicology, Biodegradation, and Efficacy of Livestock Pesticides. Proceedings of an Advanced Study Institute on Toxicity of Pesticides Used on Livestock Sponsored by the North Atlantic Treaty Organization and organized by the Research Station, Can. Dep. Agric. Lethbridge, Alberta. Amsterdam.* 434 pp.

Discussed possibility of elimination of horn fly in North America.

199. KOE, F-H. 1975. Preliminary observation on the species constitution and the seasonal fluctuations of synanthropic flies in the plain rural region of Honan province China. (In Chinese.) *Acta Entomol. Sin.* 18(1): 71-76.

200. KRAMER, H. 1917. Die musciden der oberlausitz. *Abhandlungen Naturforschenden Gesellschaft, Gorlitz* 28: 289.

201. KRAMER, J. P. 1973. Susceptibility of 16 species of muscoid flies to the microsporidian parasite, *Octospora muscaedomesticae*. J.N.Y. Entomol. Soc. 81(1): 50-53.
H. i. irritans was not susceptible to *O. muscaedomesticae*.
202. KROGERUS, R. 1932. Über die ökologie und verbreitung der arthropen der triebssandgebiete an den Küsten Finnlands. Acta Zool. Fenn. 12:119.
203. KROMBEIN, K. V., and B. D. BURKS. 1967. Hymenoptera of America north of Mexico. Synoptic Catalog. U.S. Dep. Agric., Agric. Monogr. No. 2, 2d Suppl, pp. 254-255.
204. KUNZ, S. E., J. R. CUNNINGHAM, and J. L. ESCHLE. 1973. Horn fly: use of insecticides to disrupt life cycle. J. Econ. Entomol. 66(5): 1239-1240.
Toxicant could reduce or eliminate all infestations of *H. i. irritans* if properly applied to cattle twice in 2 successive weeks. Manure pats were sampled after spraying to test effectiveness of the toxicant.
205. ——— and J. L. ESCHLE. 1971a. Possible use of the sterile male technique for eradication of the horn fly. International Atomic Energy Agency, Food and Agric. Organ., Int. At. Energy Proc. Ser. Sterility Principles for Insect Control or Eradication, pp. 145-156.
206. ——— and J. L. ESCHLE. 1971b. Use of the sterile-male technique to suppress horn flies, *Haematobia irritans* (L.). A pilot study in West Texas. Texas Conference on Insect, Plant Diseases, Weed and Brush Control Proc. 4: 128-130.
207. ——— J. L. ESCHLE, and J. R. CUNNINGHAM. 1975. Methods of estimating sterility in a field population of horn flies (Diptera: Muscidae). J. Med. Entomol. 12(5): 513-517.
Two methods of monitoring the effect of releasing sterile horn flies into a native population of flies were compared. The first method estimated fecundity and hatchability from horn fly eggs collected from individual manure pats. The second method estimated fecundity and hatchability from eggs collected from flies taken from cattle and held in laboratory cages.
208. ——— J. L. ESCHLE, and B. F. HOGAN. 1973. Suppression of a horn fly population with the sterile male technique. Folia Entomol. Mexico. 25-26: 123-124.
209. ——— J. L. ESCHLE, and B. F. HOGAN. 1976. Some bionomical aspects of horn fly populations in West Texas. Southwest. Entomol. 1: 46-48.

210. ——— M. R. GRAHAM, B. F. HOGAN, and J. L. ESCHLE. 1974. Effect of releases of sterile horn flies into a native population of horn flies. *Environ. Entomol.* 3(1): 159-162.
Low numbers of ^{137}Cs irradiated *H. i. irritans* released into a native population had no effect despite preliminary treatments with insecticide. Larger releases caused a downward trend in reproduction and resulted in about 90 percent control during the latter part of the study.
211. ——— B. F. HOGAN, R. R. BLUME, and J. L. ESCHLE. 1972. Some bionomical aspects of horn fly populations in central Texas. *Environ. Entomol.* 1(5): 565-568.
Oviposition during October and November was responsible for the spring buildup of flies on cattle during April and May. The average 0.14 flies/pat that emerged from the subsequent overwintering pupae produced an F_1 generation that averaged 1.2 flies/pat. The average monthly rate of production from May to October was 6.6 horn flies/pat when competition from other arthropods was allowed, compared with 66.8/pat when competition was essentially eliminated.
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Lyperosia exigua (= *H. i. exigua*) and *L. titillans* (= *H. t. titillans*) were collected.
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H. i. irritans was among the 67 insect species found to be associated with dung in B.C.
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Beetle activity in the field had little effect on the horn fly as the beetles ceased burial activity before midsummer when horn flies reached their greatest numbers.
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Horn flies did not show a definite diurnal rhythm in oviposition. There was a single peak adult abundance during the summer. Predators *Philonthus cruentatus* Gmelin, *Sphaeridium scarabaeoides* (L.), and *S. lunatum* (F.) were chiefly responsible for horn fly suppression in B.C. Horn fly parasites and dung burying beetles were scarce.

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Musca domestica was attracted to *H. i. irritans* cuticular hydrocarbons.

230. MAYER, R. T., and A. C. BRIDGES. 1975. Some effects of ionizing radiation on the lipid and glycogen content of adult horn flies, *Haematobia irritans*. Insect Biochem. 5(4): 387-398.

Measurements were made of the free sugar, glycogen, and lipid levels in flies treated with a 2.0 krad dose of ionizing radiation. Glycogen levels were depressed in males but remained unchanged in females. Triglyceride levels in both sexes were 50 percent lower than the control group, but there was no effect on the distribution of fatty acids among the various lipid classes.

231. ——— J. COOPER, F. M. FARR, and R. H. SINGER. 1975. Some effects of ionizing radiation on adult horn flies, *Haematobia irritans*. Insect Biochem. 5(1): 35-42.

Adult flies were irradiated from a ¹³⁷Cs source and analyzed for physiological (free) amino acids and for total (hydrolysates) amino acids. Assays showed that irradiated flies had increased levels of asparagine—glutamine and creatinine—but neither ammonia nor total amino acids were affected. Several compounds previously unreported in insects were found to occur in horn flies.

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Extracts of whole adult horn flies contained 11.0 μ -mole creatinine and 0.5-1 μ -mole creatine phosphate per gram tissue.

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Musca geniculata DeGeer, 1776 was designated type-species for *Siphona* Meigen, 1803. Designation by Westwood (1840) of *Conops irritans* Linnaeus as type-species of *Haematobia* Lepeletier and Serville, 1828 was confirmed.
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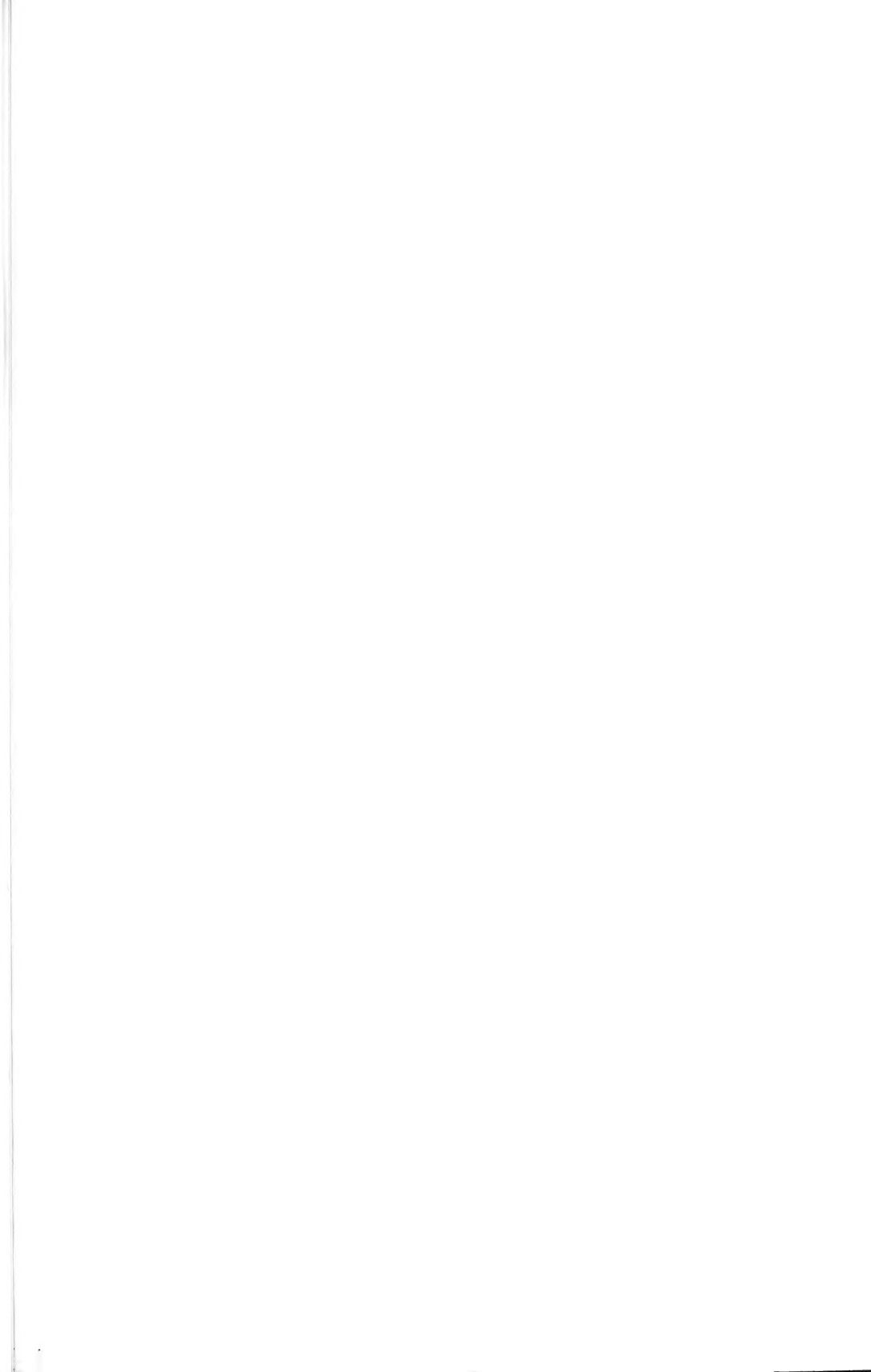
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